Ecosystems
An ecosystem is a community of living organisms interacting with each other and their environment. Ecosystems occur in all sizes. A tidal pool, a pond, a river, an alpine meadow and an oak forest are all examples of ecosystems. Organisms living in a particular ecosystem are adapted to the prevailing abiotic and biotic conditions. Abiotic conditions involve both physical and chemical factors (e.g., sunlight, water, temperature, soil, prevailing wind, latitude and elevation). In order to understand the flow of energy and matter within an ecosystem, it is necessary to study the feeding relationships of the living organisms within it.

Living organisms in an ecosystem are usually grouped according to how they obtain food. Autotrophs that make their own food are known as producers, while heterotrophs that eat other organisms, living or dead, are known as consumers. The producers include land and aquatic plants, algae and microscopic phytoplankton in the ocean. They all make their own food by using chemicals and energy sources from their environment.

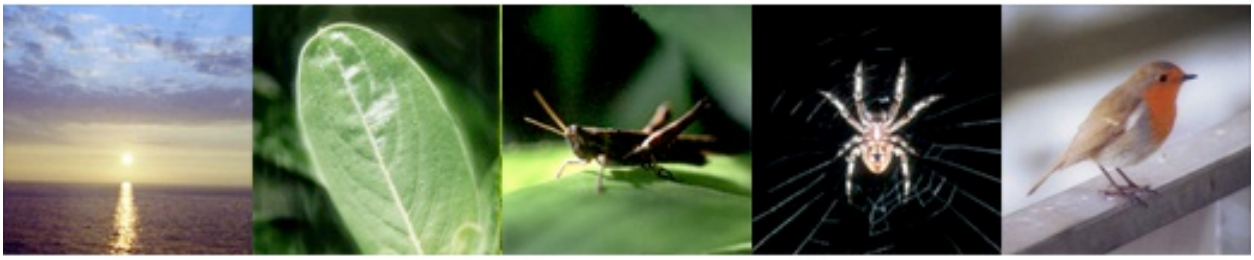
For example, plants use photosynthesis to manufacture sugar (glucose) from carbon dioxide and water. Using this sugar and other nutrients (e.g., nitrogen, phosphorus) assimilated by their roots, plants produce a variety of organic materials. These materials include: starches, lipids, proteins and nucleic acids. Energy from sunlight is thus fixed as food used by themselves and by consumers.

The consumers are classed into different groups depending on the source of their food. Herbivores (e.g. deer, squirrels) feed on plants and are known as primary consumers. Carnivores (e.g. lions, hawks, killer whales) feed on other consumers and can be classified as secondary consumers. They feed on primary consumers. Tertiary consumers feed on other carnivores. Some organisms known as omnivores (e.g., bears, rats and humans) feed on both plants and animals. Organisms that feed on dead organisms are called scavengers (e.g., vultures, ants and flies). Detritivores (detritus feeders, e.g. earthworms, termites, crabs) feed on organic wastes or fragments of dead organisms.

Decomposers (e.g. bacteria, fungi) also feed on organic waste and dead organisms, but they digest the materials outside their bodies. The decomposers play a crucial role in recycling nutrients, as they reduce complex organic matter into inorganic nutrients that can be used by producers. If an organic substance can be broken down by decomposers, it is called biodegradable.

In every ecosystem, each consumer level depends upon lower-level organisms (e.g. a primary consumer depends upon a producer, a secondary consumer depends upon a primary consumer and a tertiary consumer depends upon a secondary consumer).

All of these levels, from producer to tertiary consumer, form what is known as a food chain. A community has many food chains that are interwoven into a complex food web. The amount of organic material in a food web is referred to as its biomass.



THE FOOD CHAIN FROM ENERGY SOURCE TO TERIARY CONSUMER

When one organism eats another, chemical energy stored in biomass is transferred from one level of the food chain to the next. Most of the consumed biomass is not converted into biomass of the consumer. Only a small portion of the useable energy is actually transferred to the next level, typically 10 percent. Each higher level of the food chain represents a cumulative loss of useable energy. The result is a pyramid of energy flow, with producers forming the base level.

Assuming 10 percent efficiency at each level, the tertiary consumer level would use only 0.1 percent of the energy available at the initial producer level. Because there is less energy available high on the energy pyramid, there are fewer top-level consumers. A disruption of the producer base of a food chain, therefore, has its greatest effect on the top-level consumer.

Ecosystem populations constantly fluctuate in response to changes in the environment, such as rainfall, mean temperature, and available sunlight.

Normally, such changes are not drastic enough to significantly alter ecosystems, but catastrophic events such as floods, fires and volcanoes can devastate communities and ecosystems. It may be long after such a catastrophic event before a new, mature ecosystem can become established. After severe disturbance the make up of a community is changed. The resulting community of species changes, as early, post disturbance, fast-growing species are out-competed by other species. This natural process is called ecological succession. It involves two types of succession: primary succession and secondary succession.

Primary succession is the development of the first biota in a given region where no life is found. An example is of this is the surrounding areas where volcanic lava has completely covered a region or has built up a new island in the ocean. Initially, only pioneer species can survive there, typically lichens and mosses, which are able to withstand poor conditions.

They are able to survive in highly exposed areas with limited water and nutrients. Lichen, which is made up of both a fungus and an alga, survives by mutualism. The fungus produces an acid, which acts to further dissolve the barren rock. The alga uses those exposed nutrients, along with photosynthesis, to produce food for both. Grass seeds may land in the cracks, carried by wind or birds. The grass grows, further cracking the rocks, and upon completing its own life cycle, contributes organic matter to the crumbling rock to make soil. In time, larger plants, such as shrubs and trees may inhabit the area, offering habitats and niches to immigrating animal life. When the maximum biota that the ecosystem can support is reached, the climax community prevails. This occurs after hundreds if not thousands of years depending on the climate and location.

Secondary succession begins at a different point, when an existing ecosystem's community of species is removed by fire, deforestation, or a bulldozer's work in a vacant lot, leaving only soil. The first few centimeters of this soil may have taken 1000 years to develop from solid rock.

It may be rich in humus, organic waste, and may be stocked with ready seeds of future plants. Secondary succession is also a new beginning, but one with a much quicker regrowth of organisms. Depending on the environment, succession to a climax community may only require 100 to 200 years with normal climate conditions, with communities progressing through stages of early plant and animal species, mid-species and late successional species. Some ecosystems, however, can never by regained.

The grass grows, further cracking the rocks and upon completing its own life cycle, contributes organic content to the crumbling rock becoming soil.In time, larger plants then shrubs then trees may dominate this area, offering habitats and niches to immigrating animal life. Reaching the maximum biota this ecosystem can support, the climax community caps off further succession after hundreds if not thousands of years depending on the climate and location.

Secondary succession begins at a different point. Due to a disturbance to an existing ecosystem, such as fire, deforestation, farmland left abandoned, or even the bulldozer's work in a vacant lot, biota are removed. What does remain, however, is the soil. Soil that may have taken 1000 years to develop the first centimeter from solid rock. Soil that may be rich in humus, organic wastes. Soil that may be stocked with ready seeds of future plants. Secondary succession is also new beginning, but with the advantage of quick regrowth of organisms.

Once underway, the ecosystem's succession to its climax community may only require 100-200 years with normal climate conditions, progressing just like the primary succession through stages of early plant and animal species, mid-species, and late successional species.

ABIOTIC FACTORS OF A TERRESTRIAL ECOSYSTEM